NASA TECH BRIEF

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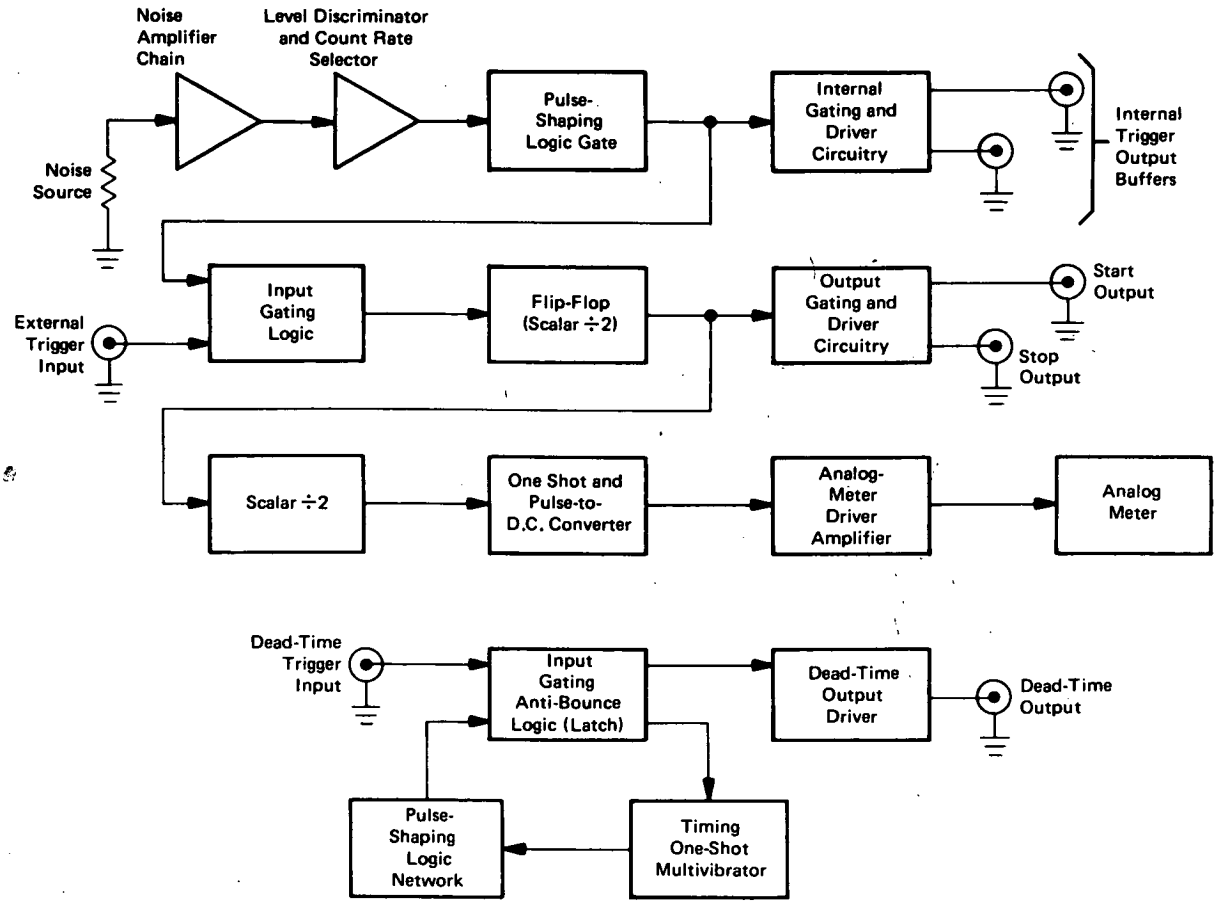
Programmable Random Interval Generator

The problem:

The application of random pulse generators varies from the measurement of human response in psychological tests to the testing of scientific equipment such as multichannel analyzers or spectrometers. Existing random pulse generators, however, are designed for narrowband output determined by specific application and do not provide the wide frequency band that can cover the entire field.

The solution:

A random pulse generator was developed which can supply constant-amplitude randomly distributed pulses with an average rate ranging from a few counts per second to more than one million counts per second.



Random Pulse Generator

(continued overleaf)

How it's done:

The noise source (see figure) is two thin-film resistors and a differential amplifier input stage (noise amplifier chain) which produces noise pulses of random occurrence and amplitude. A level discriminator converts the random pulses to constant amplitude. The pulses are then transformed to sharp pulses by a pulse-shaping logic gate, inverted, and fed as narrow positive pulses to internal trigger output buffers. The sharp pulses from the pulse-shaping gate are also fed to an external/internal logic gate (input gating logic) which can also receive external trigger inputs. The output of the internal/external gate is divided by a flip-flop and differentiated to produce negative pulses at "start" and "stop" output terminals.

The time difference between "start" and "stop" outputs is the interval between successive internal trigger pulses which allow interface with standard time-to-pulse height converters for evaluating the generator average dead time and departure from ideal randomness. The output of the first flip-flop is further divided by the second flip-flop and fed to a one-shot multivibrator and pulse-to-dc converter for supplying a calibration signal to an analog-meter driver amplifier circuit.

The input gating logic operates in the internal mode using noise pulses from the noise source or in the external mode using external positive input pulses. When a known external frequency is applied to the input logic gate, the analog meter can be calibrated to provide a count rate meter function. To generate random rectangular output pulses, the positive pulses from internal trigger output buffers are fed to an anti-bounce logic circuit which precludes erratic operation due to input pulse ringing. A pulse-shaping logic network and the one-shot multivibrator determine pulse width whereby pulses of random length and occurrence are generated.

The described random pulse generator requires no high-voltage power supply or any special thermal cooling apparatus as is characteristic of gaseous-discharge tube-type pulse generators. The device is also uniquely versatile and provides a wide dynamic range of operation. Four types of output are available:

1. Internal trigger outputs derived from the noise source;
2. Two negative-going pulse outputs derived from the internal noise source or from an external source; and
3. Rectangular positive going-pulses with an internally adjustable width.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
Johnson Space Center
Code JM7
Houston, Texas 77058
Reference: TSP73-10367

Patent status:

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning non-exclusive or exclusive license for its commercial development should be addressed to:

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Source: R. S. Lindsey, Jr., of
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